

LITTLE ROCK AND MEMPHIS ROAD.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

A report from the Topographical Bureau, in relation to the survey of so much of the Little Rock and Memphis road as lies between the St. Francis and Mississippi rivers.

JANUARY 14, 1835.

Referred to the Committee of Ways and Means.

DEPARTMENT OF WAR,

January 13, 1835.

SIR: I transmit, herewith, a report from Lieutenant Colonel Abert, of the Topographical Bureau, of this date, furnishing the information called for by the resolution of the House of Representatives of the 6th instant.

I have the honor to be,

Very respectfully,

Your obedient servant,

LEW. CASS.

Hon. JOHN BELL,

Speaker of the House of Representatives.

TOPOGRAPHICAL BUREAU,

January 13, 1835

SIR: I have the honor to lay before you "the survey and estimate of Dr. Howard, the engineer who surveyed so much of the Little Rock and Memphis road as lies between the St. Francis and Mississippi rivers," called for by a resolution of the House of Representatives of the 6th instant.

With great respect,

I remain, sir,

Your obedient servant,

JOHN J. ABERT,

Lieut. Col. Top. Eng's.

Hon. LEWIS CASS, *Secretary of War.*

WASHINGTON CITY, May 3, 1834.

Lieut. Col. J. J. ABERT,

Topographical Bureau:

SIR: In obedience to your orders, I have the honor to submit to you the following report relating to the survey, plan, and estimate "of a road from a point opposite Memphis to the west bank of the St. Francis river, in Arkansas." This report is elucidated by maps and profiles, as below.

One sheet, containing the general map of the country surveyed between the Mississippi and the St. Francis rivers, showing the route and profile of the proposed road, and its deviations from the present military road, and on a scale of one inch to one mile.

Four sheets of maps, exhibiting in detail the routes of the roads now existing, comprising the military road and the Indian trail, together with the proposed location of the intended road: also, the various offsets and experimental lines examined in order to ascertain the best ground for this location, on a scale of four inches to one mile.

Five sheets, containing the profiles of the above maps, on the same horizontal scale of four inches to one mile, and a vertical scale of one inch to ten feet.

As the proposed road extends across the swamp of the Mississippi, which is at intervals extensively inundated by the rise of the river, it is necessary to examine carefully the character of the stream and its banks, in order to ascertain on what data to form our conclusions.

The constant deposite of earth at the mouth of the Mississippi, its seeking the sea by numerous channels, frequently varying in their size, their depth, and their course, and forming what is called the delta—these circumstances together form a character which is not peculiar to this case, but is common to other large rivers liable, during their inundations, to bring down with the current large quantities of alluvial substance. The subject is too well and generally understood to render it necessary to dwell upon it here. By the operation of natural causes acting uniformly, a great part of the country formed by the deposite of such a river, which, in the case of the Mississippi, is of great extent, must necessarily be liable to be overflowed by the freshets of the stream, unless prevented by the efforts of art. What the industry of man can accomplish in such cases, is strikingly shown in the works of the Nile, the Ganges, and the Po. It is true that, in Egypt, the overflow of the stream is turned to the benefit of the country, converting what would otherwise be an arid desert into a fertile garden; but it is only as managed by the labors of art that this overflow is prevented from doing injury, and, at the same time, is made to produce benefit. In the case of the Mississippi, but little of this kind of improvement has been executed, in proportion to the immense extent of which it is susceptible; but what has been done is sufficient to show what great results are within the power of man, when the object to be attained is deemed sufficient to warrant the application of a large amount of labor and expense to it.

The Mississippi, in common with other large rivers of the same character, is subject to both periodic and occasional freshets. Of the first class, depending on natural causes acting pretty uniformly, we may generally calculate on two freshets during the year, occurring at periods

nearly regular, but varying considerably in the extent of their rise. In this particular, this stream differs from most other large rivers, which have generally only one inundation during the year sufficiently regular to be called periodic.

The first or spring freshet, as it may be termed, although sometimes beginning in January, is generally at its greatest height during the early part of March, and may be said to continue, in ordinary seasons, about six weeks. But both the period of its occurrence and the time of its duration must, however, be understood to vary considerably, according to the season. It is occasioned by the rise of the waters of the Upper Mississippi, the Illinois, the Wabash, the Ohio, the Cumberland, and Tennessee rivers. This taking place at the breaking up of winter, varies in extent, according to the quantity of snow fallen during the preceding winter, and to the rapidity with which it is melted, and, also, to the accidental circumstance whether the floods in these rivers occur all at the same time. When it happens that these take place simultaneously, then the freshet rises to its greatest height. At this period, the Missouri does not appear to exert any influence on it.

The summer freshet generally occurs early in June, and is due to the swell of the Missouri. The high land on which the head waters of this noble river take their rise, and the great extent of its course, delay its rise at its mouth to this period. It sometimes happens that an accidental season will either keep up the spring freshets in the rivers I have first enumerated, or cause a second freshet in them at the time of the rise of the Missouri. In such cases, the floods of all combined cause the inundations of the Mississippi to assume their greatest extent, and to rise to their greatest height.

A curious fact respecting the banks of the Mississippi, which has long been known, is, that these banks, where subject to be overflowed, are generally the highest at the immediate edge of the stream, and the surface of the ground is found to become lower as we proceed into the swamps behind. Our lines of levels, the accuracy of which was proved in all the most important directions, by proceeding from a determined point by one route, and returning to the same point by another route, have ascertained exactly the extent of this difference within the limits of the ground examined, as will be shown by reference to the several profiles. This elevation of the immediate bank of the river over the country behind is not peculiar to the Mississippi, but also exists in several of the large rivers of the globe, more particularly in the Po, in Italy. The manner in which it is produced by the operation of uniform causes, being now well understood, it is deemed unnecessary to enter here into a detailed examination of it, but merely to advert to the fact.

But a more remarkable circumstance attending the floods of the Mississippi is, that although the whole extent of swamp is generally overflowed to the depth of from one to two feet, to that of twenty-five or thirty feet, still the water does not rise to a uniform level, even on a line transverse to the direction of the river. It is true that it approaches nearer to a uniform level, in proportion to the duration of the inundation. Hence, when the season is such, as we have before mentioned as sometimes taking place, as to cause the spring freshets of the Ohio and Upper Mississippi to continue long enough to be joined by the freshet of the Missouri, at such time the depth of overflow reaches its maximum.

This difference of level in the high water line, in a direction perpendicular to the course of the stream, was ascertained by us in a most satisfactory manner to exist, although, from the small number and vagueness of the observations made by the inhabitants, and the uncertainty of our own observations on the moss of trees, we could not determine its extent as accurately as is to be desired. Hence, the line of high water, marked on the profiles, is to be regarded merely as an approximation to the truth, the nearest we could obtain from the imperfect information within our reach, and must be corrected by more minute observations, to be made with proper gauges, hereafter.

As it is on an attentive consideration of the causes which produce these results, combined with a minute knowledge of the ground, that our confidence is founded in the stability of the work, if executed according to the plan to be presently described, it is deemed necessary to examine this subject more in detail.

In the neighborhood of the Mississippi, for four or five miles along the proposed road, there is, on the south bank of the Grandée, a ridge or natural dyke, which is never overflowed. This ridge, following the great bend of the lake, extends a considerable distance northwards, in the direction of Greenock. It protects, in a great measure, the ground behind from the water flowing laterally from the river. It is sufficiently high and broad to be cultivated, and contains a number of farms, some of which were settled at an early period by the Spaniards. The intermediate ground between it and the high land to the west of St. Francis river, is mostly composed of swamp, annually inundated, except a few miles to the west of Lake Grandée, protected in a measure by the bank of the lake, and an occasional spot through its extent sufficiently elevated to be always a little above the reach of the water.

The surface of this swamp presents, at ordinary times, an alternating appearance of lakes, bayous, cypress ponds, and marshy ground. The lakes and bayous lie mostly in a direction nearly perpendicular to that of the proposed road, the former free from any growth of timber, except of cypress growing in the water close to the banks. The bayous proper are free from timber; but they frequently lie in broad and deep valleys, wooded, but less thickly than the higher ground, and containing comparatively little undergrowth. These valleys are, in many cases, inundated to the depth of fifteen or twenty feet, or even more. The ponds are mostly filled with very large cypress trees growing in the water, where its depth does not exceed three or four feet, except in time of overflow. The marshy ground is filled with trees of immense size, principally gum and sycamore in the lower places, and white oak and hickory in those that are a little higher and dryer, having occasionally *brakes of cane*, very thickly set, and frequently rising to the height of twenty and thirty feet, and of proportionate diameter.

During high water, as we have already observed, the interior swamp is protected, in a great degree, by the bank of Lake Grandée, from the water flowing in an immediate lateral direction from the Mississippi. The principal part of the overflow comes from a considerable distance above, in large quantities, by the bayous connected with the river, such as Tyrangée and Wappernocky, but mostly from above and below the neighborhood of New Madrid, where the river annually overflows its

western bank to a great extent. This was not the case formerly, until the earthquakes, or shakes, as they are termed, in 1811 and 1812, caused the banks to sink several feet for considerable distances up and down the river. Since that time, the waters making their way even as far as the St. Francis river have caused the inundations to be much more general and higher than formerly.

At such times, the water rises to a considerable height in the lakes and principal bayous which cross the proposed road, and forms a rapid current in them, bringing with it, in many cases, large quantities of heavy timber. In the woods, generally, it does not rise to nearly the same height, and the current is very slight from north to south, especially where the cane is thick, though it is more perceptible in a direction either eastward or westward, owing to the principal outlets overflowing their banks.

To show the grounds on which our confidence in the practicability and permanence of the proposed work is founded, let us examine the causes by which these effects are produced, and the means in our power of using them to advantage.

To render my meaning clear, it is necessary to anticipate, in some measure, what properly belongs to the sequel of this report, and to mention that the road is proposed to be raised by a levee, or dyke, sufficiently high to be above the reach of high water, with bridges wherever it crosses a bayou or small lake, so as to leave the passages for the transverse currents as free as possible. Three ferries seem to be unavoidable, unless at a disproportionate expense: one over the Mississippi, one over Blackfish lake, and one over the St. Francis river.

The language of the act of Congress of March 2, 1833, authorizing the construction of this road, is so exact in prescribing that it be made to fulfil "the purpose of establishing a constant communication from the west bank of the Mississippi towards Little Rock, in Arkansas," that all the following calculations are founded on the supposition of a road not liable to be interrupted, even at high water. It is scarcely necessary to say that a road, which would be good for the greater part of the year, might be made at much less expense than the one now proposed.

Such a plan as I have assumed seems, at first view, almost as difficult and uncertain as undertaking to dam the Mississippi itself. But let us examine the subject more closely, to find whether there are not in our power resources, drawn from the results of both theory and experience, and therefore to be depended on.

The friction of fluids passing over or against a solid body has, until late years, been very much underrated. Hence, in making the estimate of the discharge of water for many works, this friction was assumed too small, being deduced from imperfect experiments, and the results found by calculation proved to be grossly different from the actual results afforded by the works when executed. These disappointments, often repeated, led to more careful observations and experiments on a large scale, which showed that this resistance had been greatly underrated. Since the subject has been better understood, it has been applied in practice, to produce a useful effect. The retardation produced by grass to a boat passing through a canal has long been known. In this case, the friction becomes an injury; but, in other cases, it has been taken ad-

vantage of. The Lys, for example, in Flanders, is navigable for seventeen leagues, near Ghent, notwithstanding that it has a slope of from fifty to sixty centimetres to one thousand metres, which would cause it not to have sufficient water for navigation, were it not that its bed is covered with a thick growth of grass, which is carefully preserved, and which produces, in some measure, the effect of locks.

We have seen that the Mississippi swamp is covered with a heavy growth of timber, interspersed with large cane brakes, extending in every direction. These canes are larger and denser, in proportion as the time is less during which their roots are overflowed, and are largest on the ground just beyond the reach of the flood. It is to the friction offered to the water by them and the underwood that we must attribute the little current which exists in the woods generally, while in the bayous and lakes, which are free from this obstacle, the velocity, at high water, becomes very great. It is on these bayous, which are numerous, and whose openings must be carefully preserved by bridging, that we must rely for the discharge of water when there is a current; and it is believed that they will be sufficient to effect this, without changing materially the height of the rise of water, north of the road, from what now takes place. If, however, it should prove that the water be dammed up, this will be, probably, to a small extent, and there remain to us two resources, on which it is thought we may rely with confidence. The increased velocity which an additional fall of a few inches, within a short distance, would give to the current of a bayou, in a soil which is very easily excavated by a running stream, would certainly enlarge this opening, and thus augment the discharge. If this be found not to be sufficient, such is the nature of the soil that we feel assured that the command of a hydraulic pressure of even three or four inches would enable us to make, by merely digging a small trench for each, as many artificial bayous as might be found necessary.

There is one other circumstance in the formation of the country, which diminishes the obstacles we have to encounter. Blackfish lake is nearly central between the Mississippi and St. Francis rivers. At the place where the present military road crosses it, (and which is well selected,) it is a little more than one hundred yards across, and is very deep, so that the means we had at our command did not enable us to ascertain its depth. We sounded to sixty feet without finding bottom, but, judging from the steepness of its banks, it is probably more than one hundred feet deep. This is very favorable to the passage of a very large body of water, as is deduced from Eytelwein's formula, which shows that the discharge of a stream increases in a much more rapid ratio than the area of its transverse section, and which has been found to be very exact, on its being applied, by actual measurement, to streams of every size, from the feeder of a small canal to such rivers as the Ganges and the Mississippi.

Above the present ferry, Blackfish lake spreads out to a much greater breadth, and, at its head, its extensive bayous stretch so far to the east and to the west, that they appear to receive most of the waters derived from the overflow of the Mississippi above. That this is the case, is deduced from their extent and position, from the great bulk of water which passes through this channel, and from the fact that, in time of freshet,

the water of this lake contains large quantities of alluvial matter, resembling, in every respect, that of the Mississippi, and which the water of the other lakes and bayous is comparatively free from. Hence the probability that Blackfish lake receives and discharges the greatest part of the water overflowing from the Mississippi, except such as finds its way to the St. Francis river.

Deductions from the formula mentioned above show that there is no reason to apprehend that this narrow and deep channel, at the ferry, which is so favorable to the object in view, will fill up or diminish its opening, but, on the contrary, that its tendency will be constantly to enlarge, particularly in depth.

PLAN OF THE WORK.

Having thus stated the reasons on which I found my confidence in the practicability and the stability of the work, I now proceed to describe the details of the plan.

The only materials we have at command, without going to an unreasonable expense, are earth and wood, the latter in the greatest profusion. The cypress, which is well suited to our object, is abundant. As the work will be almost entirely composed of an embankment of earth, it is necessary to inquire whether the soil is proper for this purpose.

This soil appears, at first view, to be composed of loose sand, but, on a closer examination, it is found to be entirely free from sand and grit, so much so that a sharp axe may be struck into it without danger of injuring its edge. It is easily softened, and readily held in suspension by water; but when dry, and exposed to the sun and air, after being thoroughly wet, it bakes extremely hard. It appears to be entirely composed of argillaceous and decomposed vegetable matter. It is very fertile for such vegetable productions as are not liable to be injured by the hardness of the surface, and it extends to an unknown depth. It is very compressible, and it is owing to this circumstance that the present road is so excessively bad during a great part of the year. The surface of this road has been beaten down by the travel on it, and is generally lower than the ground in the woods, on either side, where the water stands to a late season; and it is, in consequence, kept in a very miry state.

Such being the character of the soil, that it is believed the stability of an embankment made of it may be relied on, we now proceed with the details of execution.

The road is proposed to be twenty-four feet broad, and, where raised, to have a side slope of two feet base to one of height. It is deemed necessary that it be raised throughout nearly its whole extent. This, however, will, for considerable distances, be required only to be done to the height of twelve or fourteen inches, to keep its surface, notwithstanding its compression, a little above the general surface of the ground.

The earth required for this purpose to be excavated from either or both sides, as most convenient, leaving always a sufficient berm at the foot of the slope, which, where the height of embankment exceeds four feet, should not be less than five feet. The excavation thus made should not, however, be allowed to form a continuous canal, but is intended to be obstructed by occasional traverses or dams, left for the purpose, and

more or less frequent, according to circumstances. Advantage might be taken of the stumps of large trees, left in their places, to give these dams the greater solidity. They should be occasionally wide enough to admit a road over them, and a ramp, or slope, provided for the passage of wagons to and from the road.

The object of leaving these traverses is to obstruct the current, and thus prevent the danger of an artificial bayou being formed at the foot of the embankment, and destroying it.

A ditch for drainage to be made parallel to the road, and at least fifty yards from it. This ditch to be made deep enough to drain off as much as possible of the water which now stands in the woods for some time after the general overflow has ceased, and to turn it, where practicable without too great difficulty, into some of the natural bayous. The trees to be girdled for twenty feet on each side of this drain. The ponds formed by the excavations made for the road may also be drained into this ditch, where practicable.

The ease with which the soil we have described is affected by water, renders it desirable to lessen the action of this agent as much as possible. The slightest observation on adjoining portions of the road, similar in every respect, except that the timber on the sides has been removed in one case, and not in the other, is sufficient to show how important it is to expose the surface to the influence of the sun and air. From the prodigious height of the timber, and the denseness of its foliage, it is believed that the greatest difficulty would be found to keep the work in good repair, if it were permitted to remain. It is therefore proposed to cut down all the timber to the extent of one hundred and twenty feet to the south of the axis of the road, and forty feet to the north of it. The desired effect would, it is true, be in a great measure produced by merely girdling the trees; but the objections to it are the danger that would ensue to travellers when the trees began to decay, and the constant obstruction to the road and consequent expense they would cause. It is not deemed necessary to cut up or remove the fallen timber, except so far as it interferes with the operations of the work, but to permit it to decay, or to destroy it, when dry, by fire. To the south, the trees to be girdled to a further extent of sixty feet.

BRIDGES.

The bridges over the bayous, &c. to be constructed in the same manner as the ordinary bridges of the country, except that they are intended to be executed with more care. Cypress to be used for all the principal parts, where easily attainable, which will generally be the case. There is, however, one departure from this mode of construction, which is in the case of the sand slough on the west bank of the St. Francis river. The great depth and breadth of this slough, and the large quantities of water and timber which occasionally pass through it, seem to require a truss bridge of at least 80 feet span. Col. Long's plan has been selected as being very economical, and at the same time presenting, in our opinion, the best arrangement of parts both for strength and durability.

DESCRIPTION AND ESTIMATE.

I now proceed to describe the road according to the location proposed, giving the reasons for the selection made, and referring to the memoir

accompanying the maps for the explanation of details. As these details can only be useful when studied with a careful examination of all the maps and profiles, they appear more properly to belong to a separate memoir than to this report.

As it has been supposed by many persons that the Indian trail offers the best line for the road, it was carefully surveyed and levelled. It is true that it sometimes furnishes a better path than the more direct route, but this is owing to its keeping, in a great measure, on the edges of ridges and bayous, where the drainage of the water is facilitated. The ground, however, over which it passes lies very low, and is subject to overflows of great depth and extent, so that it is entirely unfit for our object.

For the convenience of reference, the whole is divided into sections, according to the changes in the character of the ground.

SECTION 1.

From the bank of the Mississippi to the ridge of Grandée lake, distance four and a half miles.

The whole of this portion of the line, as located on the maps, is a hypothetical one, assumed merely for the purpose of an estimate. In the first place, the point where it leaves the bank of the river was not selected as the proper one, as it does not afford a good landing for the ferry which is above, but was chosen as affording a good opportunity for making a good bench mark, to be referred to in our different operations.

In determining on the proper location of this portion of road, we are placed between two difficulties, both of them serious, which must be most deliberately weighed before we can decide on which to encounter, or, if we conclude to meet both, in what proportion to attack each.

On the one hand, the washing and falling in of the bank at the great bend of the Mississippi, a little below the mouth of Grandée outlet, it is so rapid that, in placing an embanked road near it, we run the risk of the whole being destroyed in a short time, as was the case with the road formerly made. The regimen of this river is such that, although we constantly see this effect going on, washing away in the bends, and forming land at the points, it defies all our calculation to predict to what extent this will take place at any particular spot. All that we know is, that this operation is constantly going on until it ceases by the river's forcing its way through some new channel, where it recommences the same series of operations.

On the other hand, as we retire from the river, we find the ground to become lower and more wet and marshy, thus increasing the height of the embankment.

Thus placed between Scylla and Charybdis, it will require the greatest care and most minute observation to determine how far it is expedient to shun one, and to encounter the other. Hence, the location of this part of the road will have to be revised with the utmost attention and deliberation.

We make the estimate according to the line we have assumed.

The embankment on this line will vary from one and a half to eight feet.

Estimate.

Embankment—

42,000 cubic yards, at 15 cents,	-	-	-	\$6,300 00
11,733 do. 16 do.	-	-	-	5,237 28
21,600 do. 18 do.	-	-	-	3,888 00
22,462 do. 19 do.	-	-	-	4,267 78
18,560 do. 20 do.	-	-	-	4,124 40

Bridging—

160 running feet, at \$3 00 per foot,	-	-	-	480 00
80 do. 5 00 do.	-	-	-	400 00

Clearing bed of road of timber—

4½ miles, at \$420 per mile,	-	-	-	1,890 00
------------------------------	---	---	---	----------

Cutting and girdling timber on sides—

4½ miles, at \$220 per mile,	-	-	-	990 00
Side drains, &c., at \$100 per mile,	-	-	-	450 00

Total,	-	-	-	<u>\$28,027 46</u>
--------	---	---	---	--------------------

SECTION 2.

From the angle of the road at end of last section, to Key's house, at fork of Greenock and Little Rock roads, distance four and a half miles.

This section offers but little difficulty, being generally out of reach of high water. As has been observed, there are a number of settlements on it. Several of these have encroached too near the bank of the lake, not leaving breadth enough for the road. It will probably be well to place the line in some places, where it is now a little distance from the bank of the lake, a little nearer to it to facilitate its drainage. All the timber that is possible, should be left to the north of the road, to protect the inhabitants from the exhalations of the lake.

Estimate.

Embankment—

79,200 cubic yards, at 15 cents,	-	-	-	\$11,880 00
----------------------------------	---	---	---	-------------

Clearing timber from bed of road—

1¾ miles, at \$420,	-	-	-	735 00
---------------------	---	---	---	--------

Cutting and girdling timber to south of road—

1¼ miles,	-	-	-	275 00
-----------	---	---	---	--------

Bridging over small drains—

90 feet, at \$3 00,	-	-	-	270 00
---------------------	---	---	---	--------

Drains, &c.	-	-	-	160 00
-------------	---	---	---	--------

Total,	-	-	-	<u>\$13,320 00</u>
--------	---	---	---	--------------------

SECTION 3.

From bench mark, at fork of roads, near Key's store, to bench mark VII, three-eighths of a mile, to the west of Nichol's house, distance eight miles. Total distance from the Mississippi river, seventeen miles.

This section does not offer any difficulty of consequence. There are a number of ponds in which the water remains till late in the season, but which may be easily drained into the numerous bayous which cross the

line. That it is not liable to general overflow, is evinced by the fact that there are settlements, at intervals, for its whole distance. Although the ground falls rapidly as we proceed towards its western limit, yet it is protected by the high bank to the south and west of Millseat lake. The lake and its extensive bayous discharge, at times, a large body of water.

Estimate.

Embankment—

63,360 cubic yards, at 18 cents,	-	-	-	\$11,404 80
66,488 do. 16 do.	-	-	-	10,638 08
59,711 do. 15 do.	-	-	-	8,956 65
58,400 do. 14 do.	-	-	-	8,176 00
Clearing timber for extra breadth of road,	-	-	-	720 00
Cutting timber on both sides of road—				
7½ miles at \$240 per mile,	-	-	-	1,800 00
Bridging over bayous, 180 feet, at \$4 00,	-	-	-	720 00
Repairing and raising bridge at Millseat bayou,	-	-	-	620 00
Drains, &c.	-	-	-	250 00
Total,	-	-	-	<u>\$43,285 53</u>

SECTION 4.

From bench mark VII, west of Nichol's farm, to Blackfish lake, distance 8 miles 320 yards. Total distance from the Mississippi, 25 miles 320 yards.

The ground of this section lies very low, and is liable to a general overflow. The line of the present road was adopted, as there did not appear to be any sufficient reason for departing from it. The timber is very large.

Estimate.

Embankment—

13,200 cubic yards, at 15 cents,	-	-	-	\$1,980 00
37,546 do. 16 do.	-	-	-	6,007 36
66,488 do. 17 do.	-	-	-	11,302 96
126,720 do. 18 do.	-	-	-	22,809 60
52,018 do. 19 do.	-	-	-	9,883 42
Clearing timber for extra breadth of road,	-	-	-	740 00
Cutting timber on sides of road—				
8¼ miles, at \$275 per mile,	-	-	-	2,268 75
Drains, &c.	-	-	-	600 00
Total, -	-	-	-	<u>\$55,592 09</u>

SECTION 5.

From Blackfish lake to the angle where the line of the proposed road leaves entirely the bank of Bevin's slough, distance 8¾ miles. Total distance from the Mississippi, 33 miles 980 yards.

As the existing road was laid out, it proposed to cross Shell and Bevin's lakes by a ferry at each. As these ferries, which have never been established, would be extremely inconvenient to the use of the road, even if they could be constantly maintained, (which is doubtful, as all

the country around them is subject to annual overflow,) it is deemed most advisable to pass these lakes at their heads where they form bayous. By this course we gain somewhat higher ground, and have much greater facilities for forming bridges to allow free passage to the currents, than we could have had at the places where the present road strikes these lakes. Accordingly, soon after leaving Blackfish lake, the proposed route leaves the military road, and continues to the north of it for the rest of the section. It is necessary, however, that this location be carefully revised, especially to find the best places for crossing these bayous of the lakes. In the selection of the proper spots to effect this, too much pains cannot be taken.

After crossing Bevin's slough, the proposed road keeps on a cane ridge a little to the south of this slough, thereby gaining higher ground than that of the old road, and having the advantage of the broad valley of the slough to facilitate its drainage, and this slough also forming a protection to it from the water's coming from the north.

Estimate.

Embankment—

86,240 cubic yards, at 14 cents	-	-	-	\$1,341 51
17,820 do. 15 do.	-	-	-	1,980 00
62,577 do. 16 do.	-	-	-	10,012 32
68,566 do. 17 do.	-	-	-	11,656 22
58,080 do. 18 do.	-	-	-	10,454 40
84,529 do. 19 do.	-	-	-	16,060 51
Bridging, 700 feet, at \$4 00	-	-	-	2,800 00
Clearing bed of road of timber	-	-	-	2,480 00
Cutting and girdling timber on sides, at \$275 per mile,	-	-	-	2,303 12
Side drains, &c.	-	-	-	320 00
Total,	-	-	-	<u>\$59,408 08</u>

SECTION 6.

From the angle at the end of last section to the bank of the St. Francis river, distance 2 miles 1,400 yards. Total distance from the Mississippi, 36 miles 620 yards.

This line has been directed by the selection of a proper place for crossing Beaver slough. Though this slough is broader here than below at times of low water, this is not the case when the water rises a little. Moreover, its comparative high banks give it a great advantage for the position of a bridge to be sufficiently elevated to be passable at all times. The line proposed soon intersects the present road, and follows it for a short distance, but for the rest of the section it is thought more expedient to keep to the north of the present route, so as to strike the St. Francis river at nearly a right angle to its course, and to take advantage as much as possible of the cane ridge lying a little distance from its bank, to form a protection to the work.

Estimate.

Embankment—

25,031 cubic yards, at 15 cents,	-	-	-	\$3,754 65
58,177 do. 17 do.	-	-	-	9,890 09

26,400 cubic yards, at 18 cents,	-	-	-	4,752 00
39,013 do. 19 do.	-	-	-	7,412 47
16,000 do. 20 do.	-	-	-	3,555 55
Bridging, 360 feet, at \$4 00	-	-	-	1,440 00
Clearing timber from bed of road	-	-	-	900 00
Cutting and girdling timber	-	-	-	780 00
Total, - - - - -	-	-	-	<u>\$32,484 76</u>

SECTION 7.

From the east bank of the St. Francis river to Strong's store, $3\frac{1}{4}$ miles. Total distance from the bank of the Mississippi, 40 miles.

The location of this section as proposed, involves the construction of an expensive bridge over the sand slough. It has, however, been preferred, for the following reasons :

The route by the present ferry is very circuitous, and for a considerable distance the ground lies very low, and is subject to an overflow, in many places exceeding 15 or 20 feet. In order to open a passage by this route, free at all times, it would be necessary to raise an embankment of this extent at an extravagant expense, or to resort to what is termed in the Southern States *a long ferry*, making, at high water, a ferry of nearly a mile in extent, embarrassed, moreover, by the difficulty of contending with a rapid current.

The expense of the first of these alternatives, and the embarrassment and interruptions which would ensue from the adoption of the second, have induced us to propose to encounter the expense of bridging the sand slough. The ground on the line suggested is much more favorable than that along the road at present used.

Estimate.

The estimate of the bridge is founded on the cost of those that have been built in different parts of the country, varied according to the price of labor and materials in the neighborhood.

Embankment—

3,777 cubic yards, at 17 cents,	-	-	-	\$642 09
2,275 do. at 16 do.	-	-	-	364 00
4,400 do. at 15 do.	-	-	-	660 00
15,644 do. at 14 do.	-	-	-	2,190 16
One Long's bridge, width of a single track, composed of five spans—a centre one of 80 feet, with two others on each side, of 60 and 40 feet respectively; 280 feet, at \$30 per foot,				
	-	-	-	8,400 00
Other bridges, 80 feet, at \$3,	-	-	-	240 00
Cutting timber, &c., three miles, at \$275,	-	-	-	825 00
Total, - - - - -	-	-	-	<u>\$13,321 25</u>

Summary of estimate.

Section.	Length.	Total distance from the Mississippi.	Estimated cost.
1	4½ miles	4½ miles	28,027 46
2	4½ miles	9 miles	13,320 00
3	8 miles	17 miles	43,285 53
4	8 miles 320 yards	25 miles 320 yards	55,592 09
5	8¾ miles	33 miles 980 yards	59,408 08
6	2 miles 1,400 yards	36 miles 620 yards	32,484 76
7	3¼ miles	40 miles	13,321 25
		Total, -	\$245,439 17

In making this estimate, it has been intentionally formed very high. Whenever an item was liable to any uncertainty, the expense has been set down at the maximum, so as to include all contingencies. For instance, the uncertainty we are under as to the exact rise of water in many parts of the swamp, has induced us to assume the embankment so high that it will probably be found to exceed what is necessary, and, of course, the expense will be diminished, in proportion, below what we have reckoned it. All this has been done to ensure that the work shall be executed within the limits of the estimate, under every unforeseen disadvantage that may occur.

We do not dwell on the importance of this road, in either a military point of view, as affording a communication, the only one practicable at certain seasons, for several hundred miles up and down the river, from the States east of the Mississippi to the interior of Arkansas. A concerted invasion of the tribes accumulated on their frontier would, if made at a well chosen period, deprive this territory of all assistance from its neighbors. In a financial view, the ready access which it would afford to an immense body of public lands would justify an expense many fold of what is now proposed. The regular and ready transmission of the mail would seem, in itself, amply to warrant the undertaking.

I have been assisted, in making this survey, by C. N. Hagner, Esq., United States assistant civil engineer, and by Messrs. J. W. Smith, W. Beckwith, and H. Stansbury, civil engineers, engaged for the object. To the perseverance of these gentlemen in the performance of the arduous duty assigned to them, and to their skill in executing it, I owe the satisfactory result, so much in detail, which a careful examination of the maps and profiles will, I hope, demonstrate. The patience, and even cheerfulness, with which they submitted to the greatest fatigue, exposure, and privations, elicited my highest admiration, and calls for the expression of my warmest thanks.

The attacks of disease, affecting, more or less, the whole brigade, very violently in some instances, which were induced by this exposure, and which have partially continued to the present time, have caused this report to be delayed much beyond the period at which it might otherwise have been completed.

I have the honor to be, very respectfully,

Your most obedient servant,

WILLIAM HOWARD, *U. S. Civil Eng'r.*



